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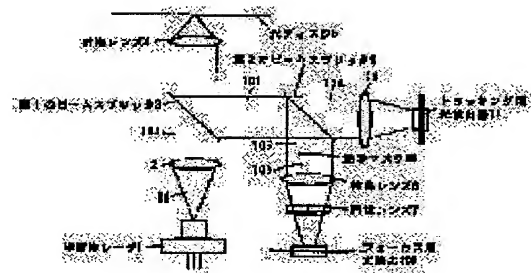
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(54) OPTICAL HEAD AND OPTICAL INFORMATION RECORDING/ REPRODUCING DEVICE USING THIS OPTICAL HEAD

(57)Abstract:

PURPOSE: To reduce the intrusion of a track crossing signal in a focus error signal particularly using an astigmatism method at the optical head for reproducing or recording/reproducing an information signal on an optical information recording medium.

CONSTITUTION: An optical member (the optical mask of a cylindrical shape 50) for reducing the central intensity of a reflective light flux is provided between a beam splitter 3 for splitting the reflective light flux into a servo detection optical system and a focus error signal optical detector 8. the astigmatism (a detection lens 6 and a cylindrical lens 7) is given to a light flux passing through it, led to the focus error signal optical detector 8 and a focus error signal is detected.



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CLAIMS

[Claim(s)]

[Claim 1]An optical head comprising:

A semiconductor laser which discharges laser luminous flux.

An object lens which condenses laser luminous flux discharged from this semiconductor laser, and it glares as light spot on a recording surface in which a track in an optical information recording medium was formed, and condenses laser luminous flux reflected on this recording surface.

A beam splitter which separates this a part of laser beam for said laser beam simultaneously with this object RENZUHE ****, and separates reflected light flux from said recording surface from an optical path which ties said semiconductor laser and said optical information recording medium.

An optical member which reduces main intensity of reflected light flux from said recording surface to circumference intensity into an optical path from said beam splitter to said photodetector in an optical head which has at least a photodetector which receives reflected light flux or transmitted light flux separated by said beam splitter.

[Claim 2]The optical head according to claim 1 having further an astigmatism generating means which gives astigmatism to reflected light flux or transmitted light flux from said beam splitter to said photodetector.

[Claim 3]Glare as light spot on a recording surface which condensed laser luminous flux discharged from a semiconductor laser which discharges laser luminous flux, and this semiconductor laser and in which a track in an optical information recording medium was formed, and. This a part of laser beam is separated for an object lens which condenses laser luminous flux reflected on this recording surface, and said laser beam simultaneously with this object RENZUHE ****, And comprise a beam splitter which separates reflected light flux from said recording surface from an optical path which ties said semiconductor laser and said optical information recording medium, and several fields where the diffraction direction differs from an angle of diffraction, and. A diffraction grating which diffracts reflected light flux or transmitted light flux separated by said 1st beam splitter, and is emitted as the diffracted light, A photodetector which receives the diffracted light from this diffraction grating also including the zero-order diffracted light, An astigmatism generating means which gives astigmatism to the diffracted light from said diffraction grating to reflected light flux from said 1st beam splitter to said diffraction grating, transmitted light flux, or said photodetector, From the zero-order diffracted light received by said photodetector, a focus error signal according to a size of a spot diameter of light spot irradiated by said optical information recording medium is detected with astigmatic method, From the primary [**] diffracted light received by said 1st photodetector, a tracking error signal according to the amount of position gaps from said track of light spot irradiated by said optical information recording medium detects, In an optical head furthermore provided with a detection means to detect an information signal on said recording surface, at least from the zero-order diffracted light or the primary [**] diffracted light, An optical head providing an optical member which reduces main intensity of reflected light flux from said recording surface to this circumference intensity into an optical path from said beam splitter to said photodetector.

[Claim 4]The optical head according to claim 3 which is provided with the following and characterized by two boundary lines of a band-like field and a lattice area border which do not have said lattice being

parallel.

A band-like field where said diffraction grating does not have a lattice.

A lattice area border where the diffraction direction differs from an angle of diffraction mutually across this field.

[Claim 5]An optical head given in either of claim 1, 2, or 3, wherein shape of a field of an optical member to which main intensity of light flux which penetrates or reflects said optical member is reduced to this circumference intensity is circular.

[Claim 6]An optical head given in either of claim 1, 2, or 3, wherein said photodetector has a quadrisection light-receiving field for detecting a focus error signal and detection sensitivity of the central part of this quadrisection light-receiving field has a field of low approximate circle shape to detection sensitivity of a periphery.

[Claim 7]Said photodetector has a quadrisection light-receiving field for detecting a focus error signal, And the directions of this parting line are 5 times - 25 degrees to the direction of a track in said optical information recording medium, And an optical head given in either of claim 1, 2, or 3, wherein astigmatic directions generated by said astigmatism generating means are 35 degrees - 55 degrees to the direction of this track.

[Claim 8]Said photodetector has a quadrisection light-receiving field for detecting a focus error signal, And the directions of this parting line are 20 degrees - 40 degrees to the direction of a track in said optical information recording medium, And an optical head given in either of claim 1, 2, or 3, wherein astigmatic directions generated by said astigmatism generating means are 65 degrees - 85 degrees to the direction of this track.

[Claim 9]Said photodetector has a quadrisection light-receiving field for detecting a focus error signal, And the directions of this parting line are 35 degrees - 55 degrees to the direction of a track in said optical information recording medium, And an optical head given in either of claim 1, 2, or 3, wherein astigmatic directions generated by said astigmatism generating means are 80 degrees - 100 degrees to the direction of this track.

[Claim 10]An optical information recording medium and a rotational driving means which rotates this optical information recording medium, In an optical information recording and reproducing device which has at least an optical head which reproduces or records an information signal on a recording surface of this optical information recording medium, and an accessing means which moves an optical head to an access direction of this optical information recording medium, An optical information recording and reproducing device, wherein said optical head consists of any 1 of said claims 1 thru/or 9.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the optical head which performs reproduction or record reproduction of an information signal to an optical information recording medium, the optical head which reduces mixing of the track traverse signal to the focus error signal by astigmatic method especially, and the optical information recording and reproducing device using this optical head.

[0002]

[Description of the Prior Art] Drawing 14 is an explanatory view showing the composition of the detecting optical system of the conventional optical head which detects the focus error signal by astigmatic method. In the figure, the light flux emitted from the semiconductor laser which is not illustrated serves as the parallel beam 100 with a collimate lens, penetrates the 1st beam splitter 3, and irradiates with the recording surface top which had the track 5a of the optical disc 5 which is an optical information recording medium formed of the object lens 4. It is reflected by the beam splitter 4 through the object lens 4, and the catoptric light 101 from the optical disc 5 produced by this exposure is led to a detecting optical system. And astigmatism is given through the cylindrical lens 7 and catoptric light enters into the photodetector 8, after converging with the detection lens 6. The photodetector 8 has the four light-receiving fields 8a, 8b, 8c, and 8d, as shown in drawing 15. Focus error detection by the astigmatic method which detects the shape change from which the spot 102 which entered into the photodetector 8 is obtained according to the distance of the object lens 4 and the optical disc 5, for example, the shape change from which it becomes an approximate circle form at the time of a focus, and becomes an ellipse form at the time of defocusing, is performed.

[0003] However, in this composition, in drawing 14, if the spot on the optical disc 5 moves to an inside-and-outside circumference from the center (just track) of the code track 5a of the optical disc 5 (offtrack), Although the spot is focusing namely, carrying out the focus just on the disk, As shown in drawing 16, the focus error signal 48 arose (it can come, and is called mixing of the track traverse signal to a focus error signal, and a leak lump of AF is called hereafter.), and the result that a focus error signal normal as a result was not acquired was brought.

[0004] On the other hand, by "the reduction measure of the groove traverse signal mixed in a focus error signal" of a statement, to the 1987 (Showa 62) autumn and the 48th Japan Society of Applied Physics academic lecture meeting lecture proceedings (17 p-ZP-2). the sum (8a+8b.) of the output of two light-receiving fields located in a line with track direction crossing at a right angle in the output of four light-receiving fields of the above-mentioned photodetector 8 After carrying out gain correcting so that 8c+8d may become constant value, the method which is going to cancel a leak lump of above-mentioned AF in circuit by forming a focus error signal is proposed.

[0005]

[Problem(s) to be Solved by the Invention] However, in the optical head in the above-mentioned proposed example, although what is depended on a position gap of the photodetector which is one of the causes of a lump [leak] of AF could be reduced, it was not taken into consideration about what is depended on the aberration of the other cause, i.e., an optical system, etc. Drawing 17 shows typically intensity change of the reflected light flux to an off-track when the aberration of the optical system which is one of the causes of a lump [leak] of AF, especially the aberration in the optical system from

the semiconductor laser 1 to the optical disc 5 arise. In a figure, a black portion shows that light intensity is strong. As shown in a figure, when an optical system has aberration, the intensity of reflected light flux The direction 200a of the code track 5a of the optical disc 5, Concerning [and] a leak lump of AF according [since it becomes unsymmetrical also to the direction 200b which intersects perpendicularly with it, a leak lump of AF will arise as a result, and] to the aberration of an optical system, The reflected light flux 101 was halved like the optical head in the above-mentioned proposed example in the track direction crossing at a right angle 200b, and SUBJECT that there was no reduction effect of a lump [leak] of AF occurred with the composition which two outputs make equal. The effect is the same although the spot 102 on the photodetector 8 is performing in the proposed example.

[0006] This invention was made in view of the actual condition of such conventional technology, and that purpose is to provide the optical information recording and reproducing device which uses the optical head which can reduce mixing of the track traverse signal to a focus error signal, and this optical head.

[0007]

[Means for Solving the Problem] Glare as light spot on a recording surface in which the above-mentioned purpose condensed laser luminous flux discharged from a semiconductor laser which discharges laser luminous flux, and this semiconductor laser, and a track in an optical information recording medium was formed, and. This a part of laser beam is separated for an object lens which condenses laser luminous flux reflected on this recording surface, and said laser beam simultaneously with this object RENZUHE ****, And a beam splitter which separates reflected light flux from said recording surface from an optical path which ties said semiconductor laser and said optical information recording medium, In an optical head which has at least a photodetector which receives reflected light flux or transmitted light flux separated by said beam splitter, It is attained by providing an optical member which reduces main intensity of reflected light flux from said recording surface to this circumference intensity into an optical path from said beam splitter to said photodetector. In this case, it is good to constitute so that it may have further an astigmatism generating means which gives astigmatism to reflected light flux or transmitted light flux from said beam splitter to said photodetector.

[0008]

[Function] In this invention, a beam splitter dissociates, and the reflected light flux from an optical disc is led to a detecting optical system, and enters into an optical member. Transmissivity (rate for Mitsutoshi) is low, for example, an optical member is an optical mask of the approximate circle shape of 50% of transmissivity here.

It is provided in the center position of light flux.

The intensity change in reflected light flux in case an optical system has aberration here is mostly produced in the center section of light flux. Therefore, when reflected light flux penetrates an optical mask, it becomes the light flux to which the intensity of the center section in the reflected light flux leading to a leak lump of AF fell. Then, if the astigmatism generating means is established, the light flux which penetrated the optical mask is an astigmatism generating means, and after it is able to give the astigmatism for focus error detection, it will enter into said photodetector. And a focus error signal is acquired using the light flux to which the intensity of the center section in the reflected light flux leading to a leak lump of AF fell.

[0009] For this reason, the optical head of this invention can acquire the good focus error signal with which mixing of the track traverse signal was reduced.

[0010]

[Example] Hereafter, the example of this invention is described in detail with reference to drawings. In the following explanation, the same reference mark is given to a component equivalent to the above-mentioned conventional example, and the overlapping explanation is suitably omitted to it.

[0011] Drawing 1 is an outline lineblock diagram of the optical head as the 1st example of this invention. In the figure, the optical head mainly comprises the semiconductor laser 1, the collimate lens 2, the 1st beam splitter 3, the object lens 4, the detection lens 6, the cylindrical lens 7, the 2nd beam splitter 9, the lens 10, and the photodetectors 8 and 11. In the optical head which consists of such each component, the sending light bunch 99 emitted from the semiconductor laser 1 which is a light source turns into the parallel pencil 100 with the collimate lens 2 first. The parallel pencil 100 is irradiated by the optical disc 5 with the object lens 4 after penetrating the 1st beam splitter 3. It is reflected by the 1st beam splitter 3 through the object lens 4, and the catoptric light 101 from the optical disc 5 enters into the 2nd beam

splitter 9, and is bisected by the transmitted light 104 and the catoptric light 105.

[0012]The light flux 104 which penetrated the 2nd beam splitter 9 enters into the photodetector 11 for tracking error signals through the lens 10. The photodetector 11 has a light-receiving field of 2 division, and it is allocated here so that it may be in agreement with the direction 200a of the code track 5a of the optical disc 5 in the incoming beam which the parting line of the two light-receiving fields described above (drawing 2). By measuring the intensity of these two light-receiving fields, the tracking error signal by the push pull method can be acquired.

[0013]On the other hand, the light flux 105 which reflected the 2nd beam splitter 9 enters into the approximate circle-shaped optical mask 50. drawing 2 showed -- as -- the optical mask 50 -- a size -- the light flux 105 -- it is small (this example size for a minute half [about]) -- it is low, for example, transmissivity is an optical member of the approximate circle shape which is 50% of transmissivity, and is provided in the center position of the light flux 105. Therefore, when the reflected light flux 105 penetrates the optical mask 50, it becomes the light flux 106 to which the intensity of the center section in the reflected light flux leading to a leak lump of AF fell. Then, after the light flux 106 which penetrated the optical mask 50 serves as convergence light and is able to give the astigmatism for focus error detection with the cylindrical lens 7 as an astigmatism generating means with the detection lens 6, it enters into the photodetector 8 for focus error signals. Since the focus error signal 48 uses the light flux 106 to which the intensity of the center section in the reflected light flux leading to a leak lump of AF fell, it turns into a good signal with which the leak lump of AF was reduced here.

[0014]In this example, although the push pull method is used for tracking-error detection, it may not restrict to this, and the 3 spotting method generally widely used for the optical head for compact disks, for example may also be used. In this case, it becomes an optical system of composition of that the focus error signal 48 and the tracking error signal 49 are detectable with one photodetector. Here, since it is not related to this invention and an essential target, detailed explanation is omitted.

[0015]Yes [in this example, by AF leaking, although the optical mask 50 for lump reduction is the composition provided into the parallel beam in the optical path from the 1st beam splitter 3 to the photodetector 8 for focus error signals, it is restricted to this, and]. An equivalent effect can be acquired even if it uses the photodetector shown after drawing 3 without using the optical mask 50 by drawing 1.

[0016]The composition which AF leaked and provided the optical member for lump reduction in the photodetector for focuses hereafter is explained.

[0017]Drawing 3 is a figure showing the arithmetic circuit for acquiring the photodetector 12 and focus error signal of AF which leak and have an optical member for lump reduction. In the figure, the photodetector 12 has the quadrisected light-receiving fields 12a, 12b, 12c, and 12d, the center section does not have detection sensitivity, namely, the rate of photoelectric conversion serves as the dead band region 12e of the circle configuration of zero mostly. The light flux 105 which reflected the 2nd beam splitter 9 enters into a quadrisection light-receiving fields [of the photodetector 12 / 12a-12d] center section as about 70-micrometer light spot 107. Therefore, the center section 107a in the light spot 107 which causes a leak lump of AF by about 35-micrometer dead band region part 12e located in the center section of the light spot 107 is not detected, but only the periphery 107b of the light spot 107 is detected by the light-receiving fields 12a-12d. Therefore, by inputting into the differential amplifier 14, after changing into voltage with the current potential converter which does not illustrate the photoelectric current 13a and 13c from the light-receiving fields 12a and 12c, and the photoelectric current 13b and 13d from the light-receiving fields 12b and 12d, The good focus error signal 48 with which the leak lump of AF was reduced can be acquired.

[0018]Drawing 4 shows the modification of the above-mentioned photodetector 12. The photodetector 15 is the composition which has the quadrisected light-receiving fields 15a, 15b, 15c, and 15d, and laminated the optical mask 15e of the circle configuration in the center section, for example, was made into 50% of transmissivity. The light flux 105 which reflected the 2nd beam splitter 9 enters into a quadrisection light-receiving fields [of the photodetector 15 / 15a-15d] center section as about 70-micrometer light spot 107. Therefore, with about 35-micrometer optical mask 15e of the circle configuration located in the center section of the light spot 107, the center section 107a in the light spot 107 which causes a leak lump of AF among the light spot 107 falls depending on the transmissivity of the optical mask 15e. Half light intensity is detected in this example. Therefore, being detected by the light-

receiving fields 15a-15d becomes the light spot to which the intensity of the center section of the light spot 107 leading to a leak lump of AF fell. The photoelectric current 16a and 16c from the light-receiving fields 15a and 15c, and the photoelectric current 16b and 16d from the light-receiving fields 15b and 15d therefore, by inputting into the differential amplifier 14, after changing into voltage with a current potential converter, The good focus error signal 48 with which the leak lump of AF was reduced can be acquired.

[0019]As mentioned above, although it was the composition of AF having leaked and having provided the optical mask for lump reduction in the quadrisection light-receiving fields 12a-12d in the acceptance surface of a photodetector, and the photodetector 12, it does not restrict to this. For example, as shown in drawing 5, the optical mask 18 (this example 50% of transmissivity) of a circle configuration may be formed in the entrance plane 8e of the photodetector 8 which has the quadrisection light-receiving fields 8a-8d shown by drawing 12. According to this composition, the good focus error signal with which the leak lump of AF was reduced almost like the above-mentioned photodetectors 12 and 15 can be acquired.

[0020]As mentioned above, as explained in detail, the good focus error signal with which the leak lump of AF was reduced can be acquired by forming the optical mask 50 for reducing the intensity of the center portion of reflected light flux into the optical path from the 1st beam splitter 3 to the photodetector 8 for focus error signals.

[0021]Next, the example used for the optical head which AF of this invention leaks and plays the magneto-optical disc which is a magneto-optics recording medium about the optical mask for lump reduction is described with reference to drawings.

[0022]Drawing 6 is an outline lineblock diagram of the optical head as the 2nd example of this invention.

[0023]The light flux 99 emitted from the semiconductor laser 1 which the superposing-high-frequency circuit 1a for reducing a noise is attached in drawing 6, and functions as a light source, It becomes the parallel pencil 151 with the collimate lens 2, the aeolotropism of the intensity of a laser beam is amended by the beam shaping prism 19, and it is changed into the isotropic parallel pencil 152. Not an indispensable optic but the composition naturally removed may be sufficient as the beam shaping prism 19.

[0024]The outgoing beam 152 of the beam shaping prism 19 is deflected 90 degrees in an optical path by the reflective mirror 20, and enters into the 1st reflector 21a of the 1st beam splitter 21. The 1st reflector 21a of the beam splitter 21 differs [polarization / P polarization and / S] in reflectance and transmissivity, for example, has the polarization characteristic of P polarization transmittance $T_p \approx 0.7$, P polarization reflectance $R_p \approx 0.3$, S polarization transmittance $T_s \approx 0$, and S polarization reflectance $R_s \approx 1$.

[0025]Light flux 152 (P polarization) which entered into the 1st reflector 21a is made into the transmitted light 153 and the catoptric light 154 for 2 minutes. Among these, the catoptric light 154 enters into the photodetector 23 after penetrating the shielding member 22 which has an opening (not shown). The shielding member 22 may not necessarily be required and may lead the light flux 154 to the photodetector 23 directly. As a measure against the stray light, to the light flux 154, the photodetector 23 inclines and is arranged. The measure against the stray light is a measure make it not enter in a semiconductor laser or other photodetectors, whose the light which is reflected in an entrance plane, and which is not needed, i.e., stray light. The light intensity of the light flux 99 discharged from the semiconductor laser 1 using the output 24 of the light flux 154 which entered into the photodetector 23 is controlled.

[0026]On the other hand, it is irradiated with it by the magneto-optical disc 27 with which the disk rotation drive means 26 which consists of spindle motors etc. with the object lens 4 was equipped after the light flux 153 which penetrated the 1st reflector 21a of the 1st beam splitter 21 of the above is able to change a direction of movement by the reflective mirror 25. The two-dimensional actuator 28 with which the optical head of this example drives an objective lens position for the reflective mirror 25, the object lens 4, and the object lens 4 to biaxial [of a focusing direction (Z-axis in a figure), and a track direction (Y-axis in a figure)], Moving only the carriage 29 which carries them from an inner circumference position to a peripheral position using an access mechanism to the access direction (Y-axis in a figure) of the magneto-optical disc 27, other optics are discrete type optical heads to fix (this optical system is henceforth called a holding part optical system.). The optical information device which

carries this discrete type optical head has the strong point in which an access speed is quick.

[0027]It is reflected through the object lens 4 and the reflective mirror 25 in the 1st reflector 21a of the 1st beam splitter 21, and the catoptric light 155 from the magneto-optical disc 27 goes to the 2nd reflector 21b. By P polarization and S polarization, the 2nd reflector 21b of the 1st beam splitter 21 differs in reflectance and transmissivity, for example, has the polarization characteristic of P polarization transmittance $T_p \approx 0.6$, P polarization reflectance $R_p \approx 0.4$, S polarization transmittance $T_s \approx 0$, and S polarization reflectance $R_s \approx 1$. Light flux 155 which entered into the 2nd reflector 21b is made into the transmitted light 157 and the catoptric light 156 for 2 minutes.

[0028]The light flux 156 which reflected the 2nd reflector 21b of the 1st beam splitter 21, It is considered as the convergence light 158 with the lens 28, and enters into the polarization beam splitter 29 which is a polarization separating means which divides an incoming beam into two polarization beams polarization beams and a polarization direction cross at right angles mutually, Polarized light separation of the polarization is carried out to the two light flux 158p (refer to drawing 7) which intersects perpendicularly mutually, i.e., P polarization, and 158 s (refer to drawing 7) of S polarization, and it enters into the photodetector 30, respectively. And the magneto optical signal 50 recorded on the magneto-optical disc 27 is renewable by the detection system which takes the difference of the detecting signal of the light-receiving field which receives the P polarization 158p in the photodetector 30, and the light-receiving field which receives 158 s of S polarization, i.e., a differential detection method.

[0029]Drawing 7 is a figure explaining the composition and the operation of the polarization beam splitter 29 which are the polarization separating means used for the optical head of this example. The parallelogram prism 29a and the parallel plate 29b with which the polarization beam splitter 29 consists of transparent optical media, such as glass, in drawing 7, It comprises the polarization film 29c formed in the plane of composition of the parallelogram prism 29a and the parallel plate 29b, and the total reflection films 29d and 29e formed in the parallelogram prism 29a and the parallel plate 29b, respectively. The polarization beam splitter 29 makes it rotate abbreviated 45 degrees, and is arranged at the circumference of the optic axis of the light flux 158 which emitted the lens 28. As for the light flux 158 which emitted the lens 28, S polarization (polarization which has vibration vertical to space in figure) ingredient is reflected for the polarization film 29c among polarization components, P polarization (polarization which has vibration parallel to space in figure) ingredient vertical to this penetrates and goes straight on, reflects the polarization film 29c with the total reflection film 29e, and penetrates the polarization film 29c again. It is reflected with the total reflection film 29d, and the P polarization 158p which penetrated 158 s of light flux reflected by the polarization film 29c and the polarization film 29c enters into the photodetector 30 which has a light-receiving field of 2 division, respectively. Then, information signals, such as the information signal 51 of the magneto-optical disc 27 which is the magneto optical signal 50 and sum signal which are difference signals of two light-receiving fields, i.e., the rugged form pit signal beforehand formed in the magneto-optical disc 27, for example, an address signal etc., are detected.

[0030]On the other hand in drawing 6, the light flux 157 which penetrated the 2nd reflector 21b of the beam splitter 21, It enters into the photodetector 33, after becoming convergence light with the detection lens 6 through 2 division diffraction grating 32 and being able to give the astigmatism for focus error detection with the cylindrical lens 7 (astigmatism generating means).

[0031]Hereafter, detection of the diffraction grating 32 for which the optical head of this example is used, and the servo signal using the photodetector 33 (the focus error signal 48 and the tracking error signal 49) is explained in detail.

[0032]First, the diffraction grating 32 is explained using drawing 8 and drawing 9. Drawing 8 is a front view showing the composition of the diffraction grating 32. The diffraction grating 32 has the band-like field 32a which does not have a lattice, and the two lattice area borders 32b and 32c (the angle which the directions 32d and 32e of the grid line of this example accomplish is abbreviated 90 degree) where the directions 32d and 32e of a grid line differ mutually across the field 32a. Namely, the two boundary lines 32f and 32g with the band-like field 32a, the lattice area border 32b, or the lattice area border 32c which does not have a lattice are parallel, It is allocated so that the direction 220 of the projected image to the diffraction grating 32 of the code track 27a of the magneto-optical disc 27 may be in agreement in 32 h of the centers of the two boundary lines. Therefore, as shown in drawing 9, the light of a center section enters into the field 32a without a band-like lattice among the incoming beams 157, The

abbreviated semicircle which contains mostly the portion 157a in which the zero-order diffracted light and the primary [+] diffracted light in information TORRAKU 27a interfere enters into one lattice area border 32b, and the abbreviated semicircle which contains mostly the portion 157b in which the zero-order diffracted light and -primary diffracted light in information TORRAKU 27a interfere enters into the lattice area border 32c of another side. The tracking error signal 49 by the push pull method can be acquired by detecting the primary [**] diffracted light from these two lattice area borders 32b and 32c, respectively, and measuring that intensity. The focus error signal 48 by astigmatic method is [the light of the center section 32a of said diffraction grating 32 and the zero-order diffracted light of the two lattice area borders 32b and 32c, i.e., directly,] detectable using the transmitted light. The two lattice area borders 32b and 32c have [the transmissivity of the direct transmitted light of the diffraction grating 32] highly (this example about 1.0) the low inner center region 32a of the lattice of the diffraction grating 32 like a graphic display (this example about 0.5). Therefore, since the intensity of the portions 157a and 157b to which the zero-order diffracted light and the primary [**] diffracted light in the code track 27a interfere in the transmitted light directly falls as a result, mixing of the track traverse signal to the focus error signal 48 can be reduced.

[0033]Next, the photodetector 33 is explained in detail using drawing 10.

[0034]The arithmetic circuit for acquiring the composition and each signal of the photodetector 33 seen from the transverse plane is shown in drawing 10. In the figure, the photodetector 33 has the light-receiving fields 33a, 33b, 33c, and 33d of the quadrisection which has the dead band region part 33i of the circle configuration which does not have detection sensitivity in a center section (the rate of photoelectric conversion is zero mostly), and the light-receiving fields 33e, 33f, 33g, and 33h which became independent to the circumference, respectively.

[0035]The light of the center section 32a of the diffraction grating 32 and the zero-order diffracted light of the two lattice area borders 32b and 32c, i.e., the transmitted light, enter into a quadrisection light-receiving fields [of the photodetector 33 / 33a-33d] center section as the light spot 34 (this example about 70 micrometers) directly. Therefore, the center section which causes a leak lump of AF among the light spot 34 is not detected by the dead band region part 33i (this example about 35 micrometers) located in the center section of the light spot 34. Therefore, it becomes a periphery of the light spot 34 to be detected by the light-receiving fields 33a-33d. Therefore, after changing the photoelectric current from the light-receiving fields 33a and 33c, and the photoelectric current from the light-receiving fields 33b and 33d into voltage with a current potential converter (not shown), the signal acquired by inputting into the differential amplifier 35 turns into the good focus error signal 48 with which the leak lump of AF was reduced.

[0036]On the other hand, the primary [**] diffracted light diffracted in the lattice area border 32b enters into the light-receiving fields 33f and 33h of the photodetector 33 as the light spot 36f and 36h, respectively. The primary [**] diffracted light diffracted in the lattice area border 32c enters into the light-receiving fields 33e and 33g of the photodetector 33 as the light spot 36e and 36g, respectively. Therefore, after changing the photoelectric current from the light-receiving fields 33e and 33g, and the photoelectric current from the light-receiving fields 33f and 33h into voltage with a current potential converter (not shown), the tracking error signal 49 by the push pull method can be acquired by inputting into the differential amplifier 37. The tracking error signal 49 is acquired also from the difference of a light-receiving fields [33h and 33g] incident light strength signal, or the difference of a light-receiving fields [33e and 33f] incident light strength signal at this time.

[0037]In drawing 10, although the approximately semicircle shape of a light spot [on light-receiving field 33e-33h / 36e-36h] image is rotating 90 degrees to the shape on the diffraction grating 32, this is because astigmatism is given with the cylindrical lens 7. Since what the light-receiving fields 33e-33h detect is light volume which enters into each field instead of shape of an image, even if the shape of an image changes, it is satisfactory in any way.

[0038]Said information signal 51 is acquired also from total of all the light-receiving fields 33a-33h by the sum of a light-receiving fields [33e-33h] incident light strength signal, the sum of a light-receiving fields [33e and 33f] incident light strength signal or the sum of a light-receiving fields [33a-33d] incident light strength signal, and the pan.

[0039]By the way, what is called focus adjustment that adjusts so that a focus error signal may serve as a predetermined value in the focusing state on the magneto-optical disc 27, In drawing 6, it is possible

by making one move the detection lens 6 and the cylindrical lens 7 to the incident light shaft orientations 117 of the incident light 157 to carry out. Or the photodetector 33 may be moved to an optical axis direction. What is called tracking adjustment that adjusts so that the tracking error signal 49 may serve as a predetermined value, when the spot on the magneto-optical disc 27 is in a track state just, In drawing 6 and drawing 9, the diffraction grating 32 is performed by moving in 32 f of two parallel boundary lines, and the direction 118 vertical to 32 g mutually. Since this adjustment is performed to the light flux 157 which is a parallel beam, inclination is not produced in the light flux which penetrated the diffraction grating 32. There is also no yield of aberration, such as astigmatism. Therefore, by moving the diffraction grating 32, an adjustment state does not go wrong and the focus error signal 48 adjusted beforehand can perform focus adjustment and tracking adjustment independently.

[0040]In this example, since the zero-order diffracted light of the diffraction grating 32 is used for detection of the focus error signal 48, also when the wavelength of the semiconductor laser 1 which is a light source is changed, the light spot 34 on quadrisection light-receiving field 33a-33d cannot move, but the right focus error signal 48 can be acquired. Since the primary [**] diffracted light by a diffraction grating is used for detection of the tracking error signal 49, the light spot 36e-36h on light-receiving field 33e-33h moves by the wavelength variation of the semiconductor laser 1, but. In the light-receiving fields 33e-33h, in order to detect the light volume which enters into each field, if a light-receiving fields [33e-33h] size is designed in consideration of movement of the light spot 36e-36h, it is satisfactory.

[0041]In detection of the tracking error signal 49 by the push pull method, when the code track of the disk was followed and the object lens 4 moved, the catoptric light from the magneto-optical disc 27 also moved in connection with it, and the tracking error signal 49 detected had a problem that offset arose. However, for tracking error signal 49 detection of this example. The light of the center section which entered into the field 32a which does not have a band-like lattice among the incoming beams 157 of the diffraction grating 32 in drawing 8 does not use, but uses the light of the portions 157a and 157b in which the light which entered into the lattice area borders 32b and 32c, i.e., the zero-order diffracted light and the primary [**] diffracted light in information TORRAKU 27a, interferes. Therefore, it is also as the strong point and doubling which can reduce offset of the tracking error signal 49 by the above-mentioned object lens movement.

[0042]As mentioned above, as explained in detail, the optical head of this example, The focus error signal 48 by astigmatic method and the tracking error signal 49 by the push pull method are collectively detected by one optical system, without degrading the magneto optical signal 50, And the good focus error signal which had mixing of a track traverse signal reduced can be acquired by using the diffraction grating 32 which does not have a lattice area border, and the photodetector 33 which has a circular optical mask.

[0043]Next, by the circumference of an incident light axis rotating and arranging the quadrisection light-receiving field of the photodetector for focus error signals explains the composition which reduces a leak lump of AF.

[0044]AF to rotation of the quadrisection light-receiving fields 33a-33d for focus error signals of the photodetector 33 leaks to drawing 11, and the relation of the amount of lumps is shown in it. The rotation shows the relative angle of the direction 160 (refer to drawing 12) of the parting line which divides the light-receiving fields 33a and 33d (33b and 33c) of the photodetector 33, and the radial direction 161 (refer to drawing 12) of the code track 27a projected on the photodetector 33 (rotation of a light-receiving field is called hereafter). The astigmatic direction 162 (refer to drawing 12) 34a of the focal line generated with the cylindrical lens 7 at this time, i.e., the direction of the spot 34 on light-receiving field 33a-33d at the time of defocusing, is the direction (the direction of the astigmatism of a cylindrical lens abbreviates to 45 degrees hereafter) of 45 degrees to the direction 161. It turns out that AF leaks and rotation reduces the amount of lumps to the maximum about about 15 degrees depending on rotation of a light-receiving field so that drawing 11 may show. Therefore, as shown in drawing 12, the direction 160 which divides the light-receiving fields 33a and 33d (33b and 33c) of the detector 33 can reduce a leak lump of AF by arranging at abbreviated 15 degree to the radial direction 161 of the code track 27a projected on the photodetector 33. What is necessary is just to set it as about 5 times - 20 degrees, although the optimum value of rotation of a light-receiving field changes with the optical constant of an optical head, the track form (focal distance etc.) of a disk, etc.

[0045]Although the above-mentioned composition is the composition that the direction of the

astigmatism of the cylindrical lens 7 is 45 degrees, it is not restricted to this. AF to the rotation of a light-receiving field at the time of making drawing 13 rotate the direction of the astigmatism of the cylindrical lens 7 according to rotation of a light-receiving field leaks, and the relation of the amount of lumps is shown. In this case, it turns out that AF leaks and rotation reduces the amount of lumps to the maximum about about 30 degrees depending on rotation of a light-receiving field so that drawing 13 may show. Therefore, if the direction of the astigmatism of the cylindrical lens 7 is made into 75 degrees and rotation of a light-receiving field is made into abbreviated 30 degree, AF will leak and lump reduction will serve as the maximum to zero rotation of a light-receiving field. If the direction of the astigmatism of the cylindrical lens 7 is made into 90 degrees and rotation of a light-receiving field is made into abbreviated 45 degree, Although a leak lump of AF increases rotation of a light-receiving field from the case of abbreviated 30 degree a little, the direction 160 of a light-receiving fields [of the detector 33 / 33a and 33d (33b and 33c)] parting line, There is the strong point which will be 45 degrees to the direction of the astigmatism of the cylindrical lens 7, and said focus adjustment can perform like the conventional composition (rotation of a light-receiving field of the direction of the astigmatism of the cylindrical lens 7 is 0 times at 45 degrees). Since the optimum value of the direction of rotation of a light-receiving field and the astigmatism of the cylindrical lens 7 changes with the optical constant of an optical head, the track form (focal distance etc.) of a disk, etc. like the above-mentioned case, a gap of about about 10 degrees is produced from the above-mentioned optimum value. Therefore, for example by 30 rotations of a light-receiving field, it becomes 20 degrees - 40 degrees.

[0046]As explained above, a leak lump of AF can be reduced by rotation of the light-receiving field for focuses of a photodetector. Even if this composition rotates and arranges the photodetector itself, it can acquire the effect same naturally.

[0047]

[Effect of the Invention]By old explanation, by this invention, the optical member which reduces the main intensity of the reflected light flux from a recording surface to circumference intensity into the optical path from a beam splitter to a photodetector was provided so that clearly.

Therefore, further, since the astigmatism generating means was established into the optical path, the optical head which can reduce mixing of the track traverse signal to a focus error signal, and the optical information recording and reproducing device provided with the optical head can be provided.

[Translation done.]

特開平6-309687

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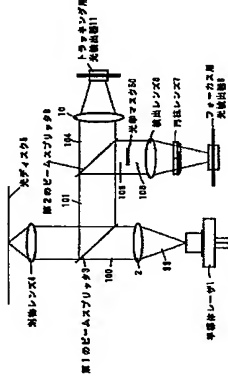
(54)【発明の名称】 光学ヘッド及びその光学ヘッドを使用した光学的情報記録再生装置

(57)【要約】

【目的】 光学的情報記録媒体に対し情報信号の再生または記録再生を行なう光ヘッドにおいて、特に非点収差法を用いたフォーカス誤差信号へのトラッキング横断信号の混入を低減する。

【構成】 反射光束をサーボ検出光学系に分離するビームスプリッタ3とフォーカス誤差信号用光検出器8との間に、反射光束の中心強度を低下させる光学部材(円形形状の光学マスク50)を設け、それを透過した光束に非点収差(検出レンズ6と円柱レンズ7)をあたえフォーカス誤差信号用光検出器8に導いてフォーカス誤差信号を検出する。

図 1



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【特許請求の範囲】

【請求項1】 レーザ光束を照射する半導体レーザと、該半導体レーザから照射されたレーザ光束を集光して、光学的情報記録媒体におけるトラッキングの形成された記録面上に光スポットとして照射すると共に、該記録面上で

反射されたレーザ光束を集光する対物レンズと、前記レーザ光束を該対物レンズへ導くと同時に該レーザ光の一部を分離し、かつ前記記録面上からの反射光束を前記半導体レーザと前記光学的情報記録媒体とを結ぶ光路より分離するビームスプリッタと、前記ビームスプリッタにより分離された反射光束もしくは透過光束を受光する光検出器とを少なくとも有する光学ヘッドにおいて、

前記ビームスプリッタから前記光検出器までの光路中に、前記記録面上からの反射光束の中心強度を周辺強度に対して低下させる光学部材を設けたことを特徴とする光学ヘッド。

【請求項2】 前記ビームスプリッタから前記光検出器に至る反射光束もしくは透過光束に非点収差を与える非点収差発生手段をさらに備えていることを特徴とする請求項1に記載の光学ヘッド。

【請求項3】 レーザ光束を照射する半導体レーザと、該半導体レーザから照射されたレーザ光束を集光して、光学的情報記録媒体におけるトラッキングの形成された記録面上に光スポットとして照射すると共に、該記録面上で反射されたレーザ光束を集光する対物レンズと、前記レーザ光を該対物レンズへ導くと同時に該レーザ光の一部を分離し、かつ前記記録面上からの反射光束を前記半導体レーザと前記光学的情報記録媒体とを結ぶ光路より分離するビームスプリッタと、回折方向または回折角の異なる複数の領域から成ると共に、前記第1のビームスプリッタにより分離された反射光束もしくは透過光束を回折格子と、該回折格子からの回折光を0次回折光も含めて受光する光検出器と、前記第1のビームスプリッタから前記回折格子に至る反射光束もしくは透過光束または前記回折格子から前記光検出器に至る回折光に非点収差を与える非点収差発生手段と、前記光検出器によって受光された0次回折光より、前記光学的情報記録媒体に照射される光スポットのスポット径の大きさに応じたフォーカス誤差信号を非点収差法により検出し、前記第1の光検出器によって受光された土1次回折光より、前記光学的情報記録媒体に照射される光スポットの前記トラッキングからの位置ずれ量に応じたトラッキング誤差信号により検出し、さらに0次回折光または土1次回折光より、前記記録面上の情報信号を検出する検出手段とを少なくとも備えた光学ヘッドにおいて、

前記ビームスプリッタから前記光検出器までの光路中に、前記記録面上からの反射光束の中心強度を周辺強度に対して低下させる光学部材を、設けたことを特徴とする光学ヘッド。

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【請求項4】 前記回折格子は、格子を有していない帯状の領域と、該領域を挟んで回折方向または回折角が互いに異なる格子領域とからなり、前記格子を有していない帯状の領域と格子領域との二つの境界線は平行であることを特徴とする請求項3に記載の光学ヘッド。

【請求項5】 前記光学部材は透過または反射の光束の中心強度を該周辺強度に対して低下させる光学部材の領域の形状が円形であることを特徴とする請求項1、2または3のいずれかに記載の光学ヘッド。

【請求項6】 前記光検出器は、フォーカス誤差信号を検出するための4分割受光領域を有し、該4分割受光領域の中心部の検出強度が周辺部の検出強度に対して低い領域の領域を有することを特徴とする請求項1、2または3のいずれかに記載の光学ヘッド。

【請求項7】 前記光検出器は、フォーカス誤差信号を検出するための4分割受光領域を有し、かつ該分割領域の方向が、前記光学的情報記録媒体におけるトラッキングの方向に対して5度〜25度であり、かつ前記非点収差発生手段により発生する非点収差の方向は該トラッキングの方向に対して35度〜55度であることを特徴とする請求項1、2または3のいずれかに記載の光学ヘッド。

【請求項8】 前記光検出器は、フォーカス誤差信号を検出するための4分割受光領域を有し、かつ該分割領域の方向が、前記光学的情報記録媒体におけるトラッキングの方向に対して20度〜40度であり、かつ前記非点収差発生手段により発生する非点収差の方向は該トラッキングの方向に対して65度〜85度であることを特徴とする請求項1、2または3のいずれかに記載の光学ヘッド。

【請求項9】 前記光検出器は、フォーカス誤差信号を検出するための4分割受光領域を有し、かつ該分割領域の方向が、前記光学的情報記録媒体におけるトラッキングの方向に対して35度〜55度であり、かつ前記非点収差発生手段により発生する非点収差の方向は該トラッキングの方向に対して80度〜100度であることを特徴とする請求項1、2または3のいずれかに記載の光学ヘッド。

【請求項10】 光学的情報記録媒体と、該光学的情報記録媒体を回転させる回転駆動手段と、該光学的情報記録媒体の記録面上の情報信号を再生または記録する光学ヘッドと、光学ヘッドを該光学的情報記録媒体のアクセス方向に移動させるアクセス手段とを少なくとも有する光学的情報記録再生装置において、前記光学ヘッドが、前記請求項1ないし9のいずれか1からなることを特徴とする光学的情報記録再生装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、光学的情報記録媒体に対し情報信号の再生または記録再生を行なう光学ヘッド、特に、非点収差法によるフォーカス誤差信号へのトラッキング横断信号の混入を低減する光学ヘッド、及びこの光学ヘッドを用いた光学的情報記録再生装置に関する。

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【0002】

【従来の技術】図14は、非点収差法によるフォーカス誤差信号を検出する従来の光学ヘッドの検出光学系の構成を示す説明図である。同図において、図示しない半導体レーザから射出された光束は、コリメートレンズ3によって平行光100となり、第1のビームスプリッタ3を透過し、対物レンズ4によって光学的情報記録媒体3である光ディスク5のトラック5aを形成された記録面上を照射する。この照射によって生じる光ディスク5からの反射光101は、対物レンズ4を経てビームスプリッタ4で反射され、検出光学系に導かれる。そして反射光は、対物レンズ6で収束した後、円柱レンズ7を経て非点収差が与えられ、光検出器8に入射する。光検出器8は図15に示すように4つの受光領域8a、8b、8c、8dを有しており、光検出器8に入射したスポット102が対物レンズ4と光ディスク5の距離に応じ得られる形状変化、例えば収差時は略円形、デフォーカス時は楕円形となる形状変化を検出する非点収差法によるフォーカス誤差検出が行われる。

【0003】しかし、この構成では、図14において、光ディスク5上のスポットが光ディスク5の情報トラック5aの中心(ジャストトラック)から内外周に移動(オフトラック)すると、スポットがディスク上に合線している、すなわちジャストフォーカスしているにもかかわらず、図16に示すように、フォーカス誤差信号48が生じ(これらフォーカス誤差信号へのトラック横断信号の混入という、以下、AFの漏れ込みと称す。)、結果的に正常なフォーカス誤差信号が得られないという結果になっている。

【0004】これに対して、1987年(昭和62年)秋季、第48回応用物理学学会術講演会講演予稿集(17p2P-2)に記載の「フォーカスエラー-信号」を混入する溝横断信号の軽減対策」では、上記光検出器8の4つの受光領域の出力において、トラック直交方向に並ぶ2つの受光領域の出力の和(8a+8b、8c+8d)が一定値となるようにゲイン補正した後、フォーカス誤差信号を形成することで回路的に上記AFの漏れ込みを解消しようとする方式が提案されている。

【0005】

【発明が解決しようとする課題】しかし、上記既提案例における光学ヘッドでは、AFの漏れ込みの原因1つである光検出器の偏斜によるものも低減可能であるが、それ以外の原因、すなわち光学系の収差等によるものに関しては考慮されていなかった。図17はAFの漏れ込みの原因1つである光学系の収差、特に半導体レーザ1から光ディスク5までの光学系における収差が生じた場合のオフトラックに対する反射光束の強度変化を模式的に示したものである。図に判るように、光学系に収差が強いことを示す。図から判るように、光学系に収差が有ると反射光束の強度は光ディスク5の情報トラック

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信号の混入が低減された良好なフォーカス誤差信号を得ることが出来る。

【0010】

【実施例】以下、本発明の実施例を図面を参照して詳細に説明する。なお、以下の説明において、前述の従来例と同等な構成要素は、同一の参照符号を付し、重複する説明は適宜省略する。

【0011】図1は本発明の第1の実施例としての光学ヘッドの概略構成図である。同図において、光学ヘッドは、半導体レーザ1、コリメートレンズ2、第1のビームスプリッタ3、対物レンズ4、検出レンズ6、円柱レンズ7、第2のビームスプリッタ9、レンズ10、および光検出器8、11から主に構成されている。このような各構成要素からなる光学ヘッドでは、光源である半導体レーザ1から射出された発散光束99は、まず、コリメートレンズ2によって平行光束100となる。平行光束100は、第1のビームスプリッタ3を透過後、対物レンズ4によって光ディスク5に照射される。光ディスク5からの反射光101は、対物レンズ4を経て第1のビームスプリッタ3で反射され、第2のビームスプリッタ9に入射し、透過光104と反射光105に二分される。

【0012】第2のビームスプリッタ9を透過した光束104は、レンズ10を経てトラックキング誤差信号用光検出器11に入射する。ここで光検出器11は2分割の受光領域を有し、その2つの受光領域の分割線が前記(図2)の入射光束における光ディスク5の情報トラック5aの方向200aと一致するように配線される。この2つの受光領域の強度を比較することにより、ブツシェルフ法によるトラックキング誤差信号を得ることが出来る。

【0013】一方、第2のビームスプリッタ9を反射した光束105は、略円形状の光学マスク50に入射する。図2で示したように、光学マスク50は大きさが光束105より小さく(本実施例では約半分の大きさ)で透過率が低い、例えば透過率50%の略円形状の光学部材であり、光束105の中心位置に設けられる。よって光学マスク50を反射光束105が透過することにより、AFの漏れ込みの原因となる反射光束中の中心部分の強度が低下した光束106となる。その後、光学マスク50を透過した光束106は、検出レンズ6によって取収光となり、非点収差発生手段としての円柱レンズ7でフォーカス調整検出のための非点収差を与えられた後、フォーカス調整信号用光検出器8に入射する。ここでフォーカス調整法は図48はAFの漏れ込みの原因となる反射光束中の中心部分の強度が低下した光束106を用いているため、AFの漏れ込みの低減された良好な信号となる。

【0014】なお、本実施例においては、トラックキング誤差検出にブツシェルフ法を用いたがこれに限るもので

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はなく、例えば一般的にコンパニティスク用光学ヘッドに広く用いられる3スポット法も用いてもよい。この場合、1個の光検出器でフォーカス誤差信号48とトラックキング誤差信号49を検出できる構成の光学系となる。ここでは本発明と本質的に関係ないの詳細な説明は省く。

【0015】また、本実施例においては、AFの漏れ込み低減用の光学マスク50は、第1のビームスプリッタ3からフォーカス調整信号用光検出器8までの光路中の平行光中に設けた構成であったがこれに限るものではない。なお、図1で光学マスク50を用いずに図3以降に示す光検出器を用いても同等な効果を得ることが出来る。

【0016】以下、AFの漏れ込み低減用光学部材をフォーカス用光検出器に設けた構成について説明する。【0017】図3は、AFの漏れ込み低減用光学部材を有する光検出器12とフォーカス誤差信号を得るための演算回路とを示す図である。同図において光検出器12は、4分割された受光領域12a、12b、12c、12dを有し、その中央部は検出領域のない、すなわち電変換率がほぼゼロの円形形状の不感帯領域12eとなっている。第2のビームスプリッタ9を反射した光束105は光検出器12の4分割受光領域12a～12dの中央部に約70μmの光スポット107として入射する。よって光スポット107の中央部に位置する約35μmの不感帯領域12eにより、AFの漏れ込みの原因となる光スポット107の中心部分107aは検出されず、光スポット107の周辺部107bのみが受光領域12a～12dによって検出される。従って、受光領域12a、12cからの光電流13a、13cと、受光領域12b、12dからの光電流13b、13dとを図示しない電流電圧変換器で電圧に変換した後、差動増幅器14に入力することにより、AFの漏れ込みが低減された良好なフォーカス誤差信号48を得ることができる。

【0018】図4は、上記光検出器12の変形例を示したものである。光検出器15は、4分割された受光領域15a、15b、15c、15dを有し、その中央部に円形状の光学マスク15eを配置し、例えば透過率50%とした構成である。第2のビームスプリッタ9を反射した光束105は光検出器15の4分割受光領域15a～15dの中央部に約70μmの光スポット107として入射する。よって光スポット107の中央部に位置する円形状の約35μmの光学マスク15eにより、光スポット107の内、AFの漏れ込みの原因となる光スポット107中の中心部分107aは光学マスク15eの透過率に依存して低下する。本実施例では半分の光強度が検出される。AFの漏れ込みの原因となる光スポット107の中心部分の強度が低下した光スポットとな

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a, 16cと、受光領域15b, 15dからの光電流16b, 16dとを、電流電圧変換器で電圧に変換した後、差動増幅器14に入力することにより、AFの漏れ込みの低減された良好なフォーカス誤差信号48を得ることができる。

【0019】以上、AFの漏れ込み低減用光学マスクを光検出器の受光面、光検出器12においては4分割受光領域12a~12dに設けた構成であったがこれに限るものではない。例えば、図5に示すように、図12で示した4分割受光領域8a~8dを有する光検出器8の入射面80cに円形状の光学マスク18（本実施例では透過率50%）を設けること。この構成によれば上記光検出器12, 15とはほぼ同様にAFの漏れ込みの低減された良好なフォーカス誤差信号を得ることができる。

【0020】以上、詳細に説明したように、反射光束の中央部分の強度を低下させるための光学マスク50を、第1のビームスプリッタ3からフォーカス誤差信号用光検出器8までの光路中に設けることにより、AFの漏れ込みの低減された良好なフォーカス誤差信号を得ることができる。

【0021】次に本発明のAFの漏れ込み低減用光学マスクを、磁気光学的記録媒体である光磁ディスクを用いる光ヘッドに用いた実施例について、図面を参照して説明する。

【0022】図6は本発明の第2の実施例としての光ヘッドの概略構成図である。

【0023】図6において、ノイズを低減するための高周波重畳回路1aが付設され、光源として機能する半導体レーザ1から放射された光束99は、コリメートレンズ2によって平行光束151となり、ビーム整形プリズム19によりレーザの非等方性を矯正されて、等方性の平行光束152に変換される。なお、ビーム整形プリズム19は必須の光学部品ではなく、当然取り除いた構成でもよい。

【0024】ビーム整形プリズム19の出射光束152は、反射ミラー20で光路を90度偏向され、第1のビームスプリッタ21の第1の反射面21aに入射する。ビームスプリッタ21の第1の反射面21aは、P偏光とS偏光とで反射率及び透過率が異なり、例えばP偏光透過率Tp≦0.7、P偏光反射率Rp≦0.3、S偏光透過率Ts≦0.5、S偏光反射率Rs≦1の偏光特性を有する。

【0025】第1の反射面21aに入射した光束152（P偏光）は透過光153と反射光154に2分される。このうち反射光154は開口（図示せず）を介して遮光部材22を透過後、光検出器23に入射する。なお、遮光部材22は必ずしも必要でなく光束154を直接光検出器23に導いてもよい。また、光検出器23は透光対策として光束154に対して傾斜して配置されている。透光対策とは、入射面において反射される必要と

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平板29bにそれぞれ形成された全反射膜29d, 29eから構成されている。偏光ビームスプリッタ29は、レンズ28を射出した光束158の光軸周りに略45度回転させて配置される。レンズ28を射出した光束158は偏光成分のうち、偏光膜29cにとってS偏光（図において紙面に垂直な振動）を持つ偏光成分は反射され、これと垂直なP偏光（図において紙面に平行な振動）を持つ偏光成分は偏光膜29cを透過して直進し、全反射膜29eで反射して再び偏光膜29cを透過する。偏光膜29cで反射された光束158sと偏光膜29cを透過したP偏光158pは全反射膜29dで反射され、それぞれ2分割の受光領域を有する光検出器30に入射する。そこで2つの受光領域の差信号である光磁気信号50、和信号である光磁気ディスク27の情報信号51、すなわち、光磁気ディスク27に予め形成された凹凸状のビット信号、たとえばアドレス信号等の情報信号が検出される。

【0030】一方、図6において、ビームスプリッタ21の第2の反射面21bを透過した光束157は、2分割し、円柱レンズ7（非点収差発生手段）でフォーカス誤差検出のための非点収差を与えられた後、光検出器33に入射する。

【0031】以下、本実施例の光学ヘッドの用いられる回折格子32と、光検出器33を用いてのサーボ信号（フォーカス誤差信号48及びトラッキング誤差信号49）の検出について詳細に説明する。

【0032】まず、図8、図9を用いて、回折格子32について説明する。図8は回折格子32の構成を示した正面図である。回折格子32は、格子を有していない帯状の領域32aと、その領域32aを挟んで格子線の方

向32d, 32eが互いに異なる2つの格子領域32b, 32c（本実施例の格子線の方向32dと32eの成す角度は略90度である）を有している。すなわち格子は有していない帯状の領域32aと格子領域32bまたは格子領域32cの二つの境界線の中央32fと32gは平行であり、その2つの境界線の中央32hに光磁気ディスク27の情報トラック27aの、回折格子32への投影された像の方向220が一致するように配設される。従って、図9に示すように、入射光束157の内、中央部の光は帯状の格子のない領域32aに入射し、情報トラック27aでの0次回折光と+1次回折光が干渉する部分157aをほぼ含む略半円が一方の格子領域32bに入射し、情報トラック27aでの0次回折光と+1次回折光が干渉する部分157bをほぼ含む略半円が他方の格子領域32cに入射する。この2つの格子領域32b, 32cからの±1次回折光をそれぞれ検出し、その強度を比較することにより、プッシュプル法によるトラッキング誤差信号49を得ることができる。また、前回折格子32の中央部32aの光と2つの格子領域

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32b, 32cの0次回折光、すなわち直接透過光を用いて非点収差法によるフォーカス誤差信号48を検出できる。また図示のように、回折格子32の直接透過光の透過率は、回折格子32の格子の中央領域32aが高（本実施例ではほぼ1.0）、2つの格子領域32b, 32cは低い（本実施例ではほぼ0.5）。よって、結果的に直接透過光は情報トラック27aでの0次回折光と±1次回折光が干渉する部分157a, 157bの強度が低下するため、フォーカス誤差信号48へのトラッキング誤差信号の漏入を低減できる。

【0033】次に、図10を用いて光検出器33を詳細に説明する。

【0034】図10に正面から見た光検出器33の構成と各信号を得るための演算回路とを示す。図10において、光検出器33は、中央部に検出強度のない（光電変換率がほぼゼロ）円形状の不感増幅部33iを有する。4分割の受光領域33a, 33b, 33c, 33dと、その周囲にそれぞれ独立した受光領域33e, 33f, 33g, 33hを有している。

【0035】回折格子32の中央部32aの光と2つの格子領域32b, 32cの0次回折光、即ち、直接透過光は、光検出器33の4分割受光領域33a~33dの中央部に光スポット34（本実施例では約70μm）として入射する。よって光スポット34の中央部に位置する不感増幅部33i（本実施例では約35μm）により、光スポット34の内、AFの漏れ込みの原因となる中心部分は検出されない。よって受光領域33a~33dによって検出されるのは光スポット34の周辺部となる。従って、受光領域33a, 33cからの光電流と、

30 受光領域33b, 33dからの光電流とを、電流電圧変換器（図示せず）で電圧に変換した後、差動増幅器35に入力することにより得られる信号は、AFの漏れ込みの低減された良好なフォーカス誤差信号48となる。

【0036】一方、格子領域32bで回折された±1次回折光は、それぞれ光検出器33の受光領域33f, 33gに光スポット36f, 36gとして入射する。格子領域32cで回折された±1次回折光は、それぞれ光検出器33の受光領域33e, 33gに光スポット36e, 36gとして入射する。従って、受光領域33e, 33gからの光電流と、受光領域33f, 33gからの光電流とを、電流電圧変換器（図示せず）で電圧に変換した後、差動増幅器37に入力することにより、プッシュプル法によるトラッキング誤差信号49を得ることが

40 できる。またトラッキング誤差信号49はこのとき受光領域33hと33gの入射光強度信号の差、または受光領域33eと33fの入射光強度信号の差からも得られる。

【0037】図10において、受光領域33e~33h上の光スポット36e~36hの像の略半円形状は回折格子32上の形状に対して90度回転しているが、これ

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は円柱レンズ7によって非点収差が与えられているためである。受光領域33a~33hによって検出するのは像の形状ではなく各領域に入射する光量であるため、像の形状が変化してもならん問題は無い。

【0038】また、前記情報信号51は、受光領域33e~33hの入射光強度信号の和、または受光領域33e~33hの入射光強度信号の和、或いは、受光領域33a~33dの入射光強度信号の和、さらに、全受光領域33a~33hの総和からも得られる。

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【0039】ところで、光磁気ディスク27上での台無状態のとき、非点収差信号が所定の値となるように調整を行なう、いわゆるフォーカス調整は、図6において、検出レンズ6と円柱レンズ7とを一体に入射光157の入射光軸方向117に移動させることにより、行なうことが可能である。或いは、光検出器33を光軸方向に移動してもよい。また、光磁気ディスク27上のスポットがジャストトラック状態のときトラッキング誤差信号49が所定の値となるように調整を行なう、いわゆるトラッキング調整は、図6、及び図9において、回折格子32をお互いに平行な二つの境界線32fと32gとに垂直な方向118に移動することにより行なう。この調整が平行方向118に移動することにより行なわれる。また非点収差等の収差の発生量もない。よって予め調整したフォーカス誤差信号48は、回折格子32を移動することによって調整状態が狂うことがなく、フォーカス調整とトラッキング調整を独立に行なうことができる。

【0040】また本実施例では、フォーカス誤差信号48の検出に回折格子32の0次回折光を用いているため、光源である半導体レーザー1の波長が変動した場合も、4分割受光領域33a~33d上の光スポット34が移動せず、正しいフォーカス誤差信号48を得ることができ、なお、トラッキング誤差信号49の検出には回折格子による±1次回折光を用いているため、半導体レーザー1の波長変動により受光領域33e~33h上の光スポット36e~36hが移動するが、受光領域33e~33hでは各領域に入射する光量を検出するため、受光領域33e~33hの大きさを光スポット36e~36hの移動を考慮して設計すれば問題ない。

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【0041】またプッシュプル法によるトラッキング誤差信号49の検出では、ディスクの情報トラック27から対物レンズ4が移動すると、光磁気ディスク27からの反射光もそれに伴って移動し、検出されるトラッキング誤差信号49にオフセットが生じるという問題が出た。しかし、本実施例のトラッキング誤差信号49検出したには、図8における、回折格子32の入射光線157の内、帯状の格子のない領域32aに入射した中央部の光は用いず、格子領域32bと32cに入射した光、すなわち情報トラック27aでの0次回折光と±1次回折光が干渉する部分157a、157bの光を用いてい

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る。よって、上記した対物レンズ移動によるトラッキング誤差信号49のオフセットを低減できる最長も合わせもっている。

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【0042】以上、詳細に説明したように本実施例の光学ヘッドは、光磁気信号50を劣化させることなく、非点収差法によるフォーカス誤差信号48とプッシュプル法によるトラッキング誤差信号49を1系統の光学系で一括して検出し、かつ、格子領域を有しない回折格子32と円形の光学マスクを有する光検出器33を用いることにより、トラッキング誤差信号の歪入を低減された良好なフォーカス誤差信号を得ることが出来る。

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【0043】次に、フォーカス誤差信号用光検出器の4分割受光領域に入射光軸回り回転して配置することにより、A Fの漏れ込みを低減する構成について説明する。

【0044】図11に光検出器33のフォーカス誤差信号用4分割受光領域33a~33dの回転に対するA Fの漏れ込み量の関係を示す。なお回転量は光検出器33の受光領域33aと33d(33bと33c)を分割する分割線33aと33d(33bと33c)と、光検出器33の分割線33aと33d(33bと33c)の半径方向161(図12参照)の方向160(図12参照)と、光検出器33に投影された情報トラック27aの半径方向161(図12参照)との相対角度を示している(以下、受光領域の回転と称す)。またこのとき円柱レンズ7で発生する非点収差の方向162(図12参照)、すなわち、デフォーカス時の受光領域33a~33d上のスポット34の総線方向34aは、方向161に対して45度方向(以下、円柱レンズの非点の方向が45度と略す)である。図11から判るようにA Fの漏れ込み量は受光領域の回転に依存し、回転が約15度付近で最大に低減することが判る。よって図12に示すように、検出器33の方向160は、光検出器33に投影された情報トラック27aの半径方向161に対して略15度に配置することにより、A Fの漏れ込みを低減できる。なお受光領域の回転の最適値は、光ヘッドの光学寸数(焦点距離等)やディスクのトラック形状等により変化するが、ほぼ5度~20度に設定すれば良い。

【0045】上記構成は、円柱レンズ7の非点の方向が45度の構成であるがこれに限るものではない。図13に円柱レンズ7の非点の方向を受光領域の回転に応じて回転させた場合の、受光領域の回転に対するA Fの漏れ込み量の関係を示す。この場合、図13から判るようにA Fの漏れ込み量は受光領域の回転に依存し、回転が約30度付近で最大に低減することが判る。よって、円柱レンズ7の非点の方向を75度とし、受光領域の回転を略30度とすれば、A Fの漏れ込み低減は受光領域の回転0度に対して最大となる。また円柱レンズ7の非点の方向を90度とし、受光領域の回転を略45度とすれば、受光領域の回転を略30度の場合より若干A Fの漏れ込みは増加するが検出器33の受光領域33aと33d(33bと33c)の分割線33aと33d(33bと33c)の方向160は、円柱レ

【図2】

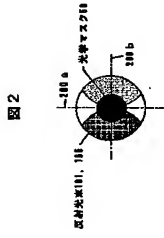


図2

【図11】

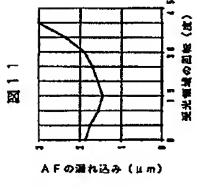


図11

【図13】

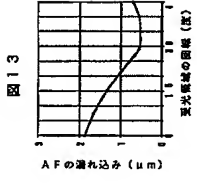


図13

14
【図9】第2の実施例に係る光学ヘッドに用いられる回折格子の光利用効率を示す説明図である。

【図10】第2の実施例に係る光学ヘッドに用いられるフォーカス誤差信号、およびトラッキング誤差信号用光検出器の構成を示す図である。

【図11】光検出器のフォーカス誤差信号用受光領域の回転とフォーカス誤差信号へのトラック横断信号の歪入の関係を示す図である。

【図12】光検出器のフォーカス誤差信号用受光領域を回転した構成の説明図である。

10
【図13】光検出器のフォーカス誤差信号用受光領域の回転とフォーカス誤差信号へのトラック横断信号の歪入の関係を示す図である。

【図14】従来例に係る光学ヘッドの構成を示す概略構成図である。

【図15】非点収差を用いたフォーカス誤差信号を検出する光検出器の説明図である。

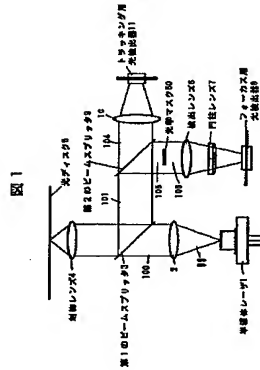
【図16】フォーカス誤差信号へのトラック横断信号の歪入を説明した図である。

20
【図17】光ヘッドに収差が有った場合のディスク上のスポットがオートトラックしたときの反射光線の変化を示した図である。

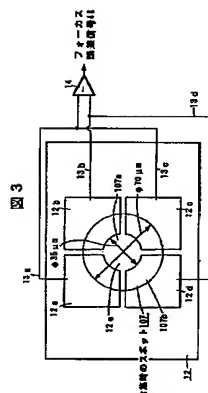
【符号の説明】

- 1 半導体レーザー
- 2 コリメートレンズ
- 3, 21 第1のビームスプリッタ
- 4 対物レンズ
- 5 光ディスク
- 6 検出レンズ
- 7 円柱レンズ
- 8, 48 フォーカス誤差信号用光検出器
- 9 第2のビームスプリッタ
- 11, 49 トラッキング誤差信号用光検出器
- 18 光学マスク
- 27 光磁気ディスク
- 30 光磁気信号用光検出器
- 32 回折格子
- 33 サークル信号用光検出器
- 50 光学マスク

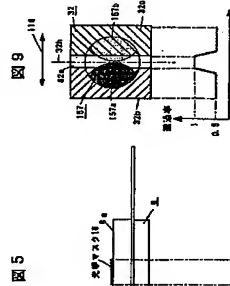
【図1】



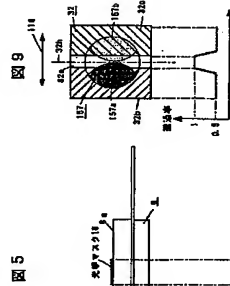
【図3】



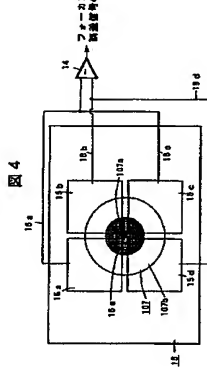
【図5】



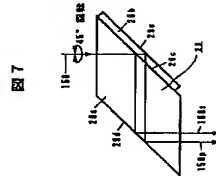
【図9】



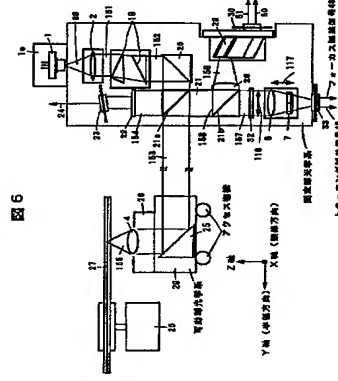
【図4】



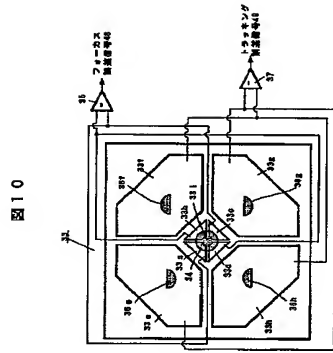
【図7】



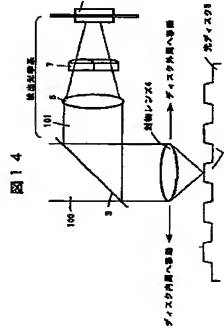
【図6】



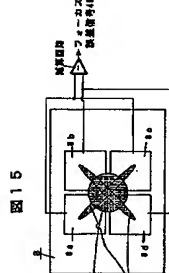
【図10】



【図14】

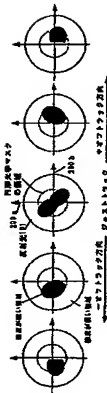


【図15】



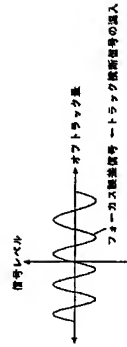
【図17】

図 17



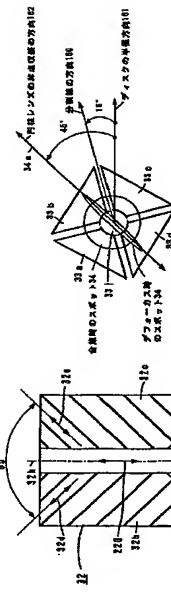
【図16】

図 16



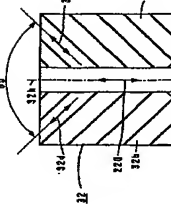
【図12】

図 12



【図8】

図 8



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